The National Center for Manufacturing Sciences (NCMS) and the Commercial Technologies for Maintenance Activities (CTMA) Program

Update of Activities

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NCMS Mission

The NCMS mission is to build the global competitiveness and strengthen the US-based manufacturing industry, private and public.


Who we are...
Ford
GM
DAIMLERCHRYSLER
EDS
USCAR
acer
Rolls-Royce
GENERAL LASERTRONICS CORPORATION
Edypse International Corporation
RVSI
Foster-Miller
UNIVERSITY OF MICHIGAN
MichiganTech
AMT
3D SYSTEMS
intel.
Benchmark Electronics INC
GE Aircraft Engines
nmes INC
WAYNE STATE UNIVERSITY
INTELLI WORXX
Parelec
Rockwell Automation
Baxter
Kodak
CATERPILLAR
EXTRUDEHONE
UNOVA
Cross Hüller
ThyssenKrupp
GENERAL PATTERN COMPANY
CCMALI
Kettering University
HPM CONSORTIUM
Stratasys INC
STORAGETEK
RLWINC.
EMBEDDEDSOFTWARE
NEMI National Electronics Manufacturing Initiative, Inc.
NATIONAL ASSOCIATION NAMF OF METAL FINISHERS
precam
BOEING
adept
ADEPT TECHNOLOGY, INC.
OAI
Honeywell
LIS Laser Imaging Systems
NASA
PRICEWATERHOUSECOOPERS
GENERAL ATOMICS Energy Products
VIC Leak Detection
GAGE
API
MLI Manufacturing Laboratories, Inc
Automated Precision Inc.
MOTORSOFT
MicroDexterity Systems
MicroFab TECHNOLOGIES • INC.
Precon
Collins & Aikman
WISCONSIN Department of Commerce
THE AEROSTRUCTURES CORPORATION
Hamilton Sundstrand
A United Technologies Company
SOLIDICA
United Technologies
HY-TECH
Endicott Interconnect
ASU ARIZONA STATE UNIVERSITY
EATON
DELPHI
Kinefac Corporation
DCT DEFORMATION
AMATROL
PPG Industries
IMPACT ENGINEERING
SIS
KNOVALENT
LESZYNSKI Group
Raytheon
AvPro
National Research Council Canada
Technology Answers, Inc.
ncms
Collaboration that works.

We Deliver….

- Technology solutions
- Strategic partnerships
- Neutrality
- Program management expertise
- Business practice solutions
- Knowledge capture & e-learning solutions
- Networking opportunities

Who we are- a full complement of program support capabilities

- Program Management
- Finance and Accounting
- Contract Administration
- Legal
- Communications & Public Relations
- Management Information Systems
- Electronic Collaboration

Commercial Technologies for Maintenance Activities (CTMA)

- Identify, form, launch and deploy new projects coupling the needs and strengths of commercial industry with the DoD's maintenance, repair and remanufacturing facilities
- Focus on reducing increasing readiness and overall costs
- Cooperative Agreement between NCMS and the Office of the Secretary of Defense
- DoD-industry co-funding on a 2:1 match basis
- http://ctma.ncms.org

DoD Participants

- Tobyhanna Army Depot (AD)
- Corpus Christi AD
- Red River AD
- Anniston AD
- Fort Richardson, Fort Wainwright
- LAV Program Office

- Norfolk Naval Shipyard (NSY)
- Portsmouth NSY
- Pearl Harbor NSY
- Puget Sound NSY

- Marine Corps Maintenance Center Albany
- Marine Corps Maintenance Center Barstow

- Naval Air Depot North Island (NADEP)
- NADEP Jacksonville
- NADEP Cherry Point

- OC- Air Logistics Center (ALC)
- OO- Air Logistics Center (ALC)
- WR-ALC
- Elmendorf AFB
- B-2 Program Office

- Naval Submarine Base- Kings Bay
- Naval Submarine Base- Bangor

- Naval Undersea Warfare Center, Keyport
- Naval Surface Warfare Center, Crane

Active CTMA Projects

1. Advanced Digital Fabrication and Repair
2. Advanced Next Generation Inspection System (NGIS III)
3. Automated Test Equipment Test Program Set Migration System
4. Automated Test Equipment (ATE) Synthetic Instrumentation
5. Barstow Air Pollution Control System Improvements
6. Damage and Wear Assessment Using Condition-Based Monitoring
7. Enhanced Wiring Integrity Systems (EWIS)
8. Flat Wire Deposition
9. Heat Transfer Classification for Production Tooling and Composite Repairs
10. Replacement for Hexavalent Chromium in Surface Finishing Processes
11. Implementation of Hard Chrome Plating Tooling
12. Isotropically Conductive Adhesives
13. Cold (Kinetic) Spray Processing
14. Laser Coating Removal Systems
15. Laser Engineered Net Shape Forming (LENS)(TM)
16. High Productivity Portable Laser Depainting Device
17. Light Armored Vehicle Condition Based Maintenance
18. Opticam/IPOMX
19. Product Lifecycle Management (PLM) for Six-Sigma Part Quality, Phase II
20. Robotic Painting Optimization
21. Smart Machine Pilot Project
22. Static Event Detector

PROJECT:**Advanced Digital Fabrication and Repair (ADF&R), A Rapid Manufacturing and Repair Program (RM&R)**

OBJECTIVES: Share and increase the joint investigation, evaluation, piloting, and implementation of ADF technologies among project participants and Defense Depots for the purpose of inserting and promoting the application of ADF&R technologies.Effect technology transfer and dissemination through close collaboration with industry partners and active participation of DoD Maintenance Facilities.Maintain collaboration with ADF industrial providers of equipment, materials, and software.Broaden technology insertion into additional DoD facilities. Conduct Rapid Manufacturing & Repair workshops, training sessions and project identification visits for interested DoD facilities.

PARTICIPANTS: PHNSY; NNS – Philadelphia Detachment; TRF Kings Bay; OC-ALC; NUWC Keyport; PNS; NAVAIR China Lake; ANAD; UTC/Pratt & Whitney; Raytheon Systems; General Pattern; NNSA Honeywell FM&T; NASA MSFC

STATUS: Reverse engineering (RE) studies among all the participants will become a shared database of RE software and hardware capabilities, and a program of materials research for rapid manufacturing of near net and net shape parts launched in March with the receipt of the first EOS INT M270 in North America are proceeding on schedule. Evaluation results from PolyWorks, HighRES and PowerInspect for RE were analyzed and reported at the CTMA Symposium in April. Team plans to analyze raw Cloud of Points from each system combination and compare performance against the CAD, C-scan, radiographic and CMM data of our standard "Amber Part". Installation of and training on new RE capabilities at TRF and Keyport were completed during this past quarter. Tests using the Amber part continue.Team partners have built parts for multiple applications for TRF Kings Bay and now for new team partner, Anniston Army Depot. A case study using POM's laser deposition technology for the repair of an impeller began 1Q 2005; results should be available 3Q 2005. The EOS INT M270 was delivered and installed 1Q 2005 at General Pattern and the RM&R team met at General Pattern to view its operation and capabilities just prior to the CTMA Symposium. The FDM 3000 RP machine was recently transferred from China Lake to Anniston Army Depot. Installation of and training on the FDM 3000 will occur early in Q3 2005.

Rapid Prototyping Technology Advancement - $1,000,000/year Savings Potential

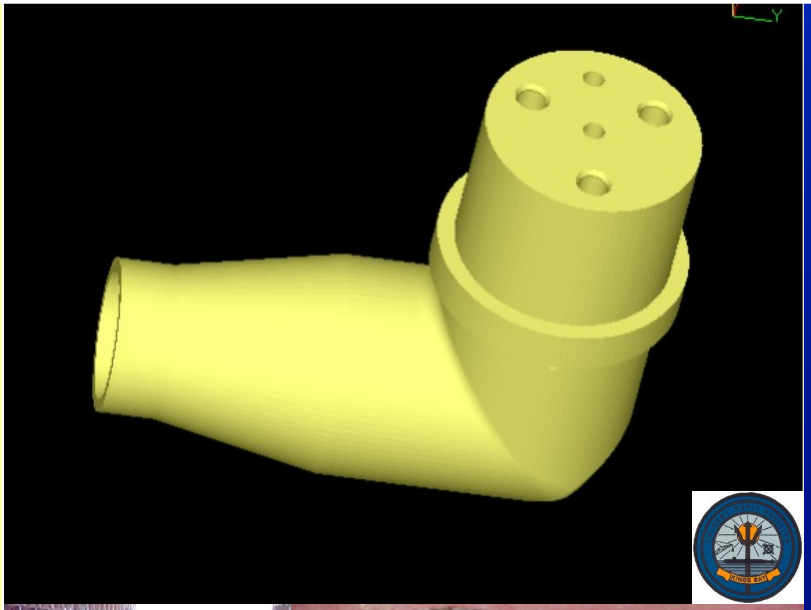
TRIDENT Submarine Tow-Point Cable Conn. (OK-542)

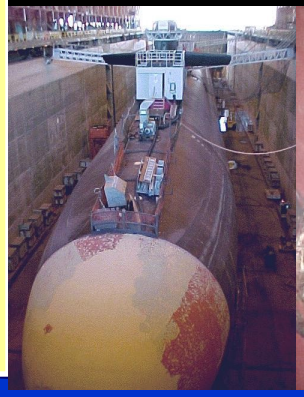
Problem/Challenge:

- Consistent failure of critical Tow Point Connector Cable due to design flaw and material degradation
- High cost and complexity to replace

Solutions/Results:

- NAWCWPNS and Pratt & Whitney teamed to deliver a rapid prototype tool in 14 days
- NAWCWPNS prepared an STL file from DOD's JEDMICS system
- Pratt & Whitney built the tool using the stereolithography process
- TRF created several injection mold prototypes with a variety of materials to find optimal solution





PROJECT: **Advanced Next Generation Inspection System (NGIS) III**

OBJECTIVES: The project targets the need to provide dimensional measurement and on-the-fly scanning of surfaces capabilities at high speed both in a CMM and on-the-machine environments with multiple, interchangeable sensors. NGIS III targets implementation of the new technology that resulted from previous industrial collaborations into a pilot program at the Cherry Point NADEP. The industry-led pilot will demonstrate significant cost and throughput savings applicable to other DoD maintenance activities supporting aircraft engines. Key is reducing the time required for current inspection practices while achieving increasing accuracy in measurements. Deliverables will include a self-sufficient, multi-axis grinding machining system for near-net shape blending of airfoil shapes on repaired impellers and turbine wheels. The machining system will incorporate on-the-machine inspection featuring advanced interchangeable sensors, an open architecture control, and programmable software with demonstrated performance ready for turnkey installation at Cherry Point NADEP to achieve an average 60% reduction at Cherry Point in labor hours and cycle time for the sample parts in the benching and hand grinding time from the current times.

PARTICIPANTS: NADEP CP; NNS – Philadelphia Detachment; OC-ALC; Manufacturing Resources, Inc. (MRI); Applied Precision, Inc. (API); Solar Turbines

STATUS: The project has been stalled for several months by a software problem in translating probe data at blade edges. This resulted from the need to relate the position, or angle, of the probe to the data being collected as the probe moved rapidly around the blade edge. The problem resulted in data gaps that precluded the required .002” accuracy for machining. In June, a software fix was found by API, and tested on both master and welded blades that have resolved the problem. This is a very significant breakthrough in the state of the art. The NGIS software has been modified and further tests run on the machine with improved results. The project continues to benefit from the degree of in-depth involvement by NEAC personnel through weekly teleconferences with the project team, and CMM work. Machine accuracy and cycle times are within the original goals. These results indicate that planned cost savings, along with cycle time reductions, remain realistic. The machine runoff is targeted for December 1, 2005. After the runoff in Cleveland, the system will be moved to Cherry Point for installation.

PROJECT: **Legacy Test Program Set (TPS) Migration System**

OBJECTIVES: Electronics repair facilities continue to support legacy test systems well beyond their life expectancies. The retention of the outdated repair capability jeopardizes weapon system availability. Costs associated with migrating or redeveloping test program set (TPS) software is the primary impediment to replacing legacy test systems. Test software migration costs can approach 20 times the cost of the replacement test system. Technologies are needed that can reduce the cost of test software migration as automated test equipment (ATE) systems become completely unsupportable.Broad project objectives include:Minimize recurring cost when migrating TPS to new ATE platforms Develop automated methods for extracting test requirements from legacy ATE/TPSDevelop “middleware” to generate new TPS on modern systemsEnable data collection for trend analysis and knowledge base

PARTICIPANTS: D. WR-ALC; TYAD; USAF Aeronautical Systems Center (Aging Aircraft Division); NADEP CP; Teradyne; Support Systems Associates, Inc. (SSAI)

STATUS: The project has been delayed due to contract negotiations between Teradyne and Boeing for Direct Test product enhancements, concerns with the viability of the previously proposed solutions, and resource rotations within Teradyne.Due to these rotations Teradyne has elected to pool contract resources from SSAI in part to forward the program. Target dates include a detailed design review with SSAI prior to July 30, '05. ATLAS training for the Teradyne & SSAI team in Melbourne, FL is slated for July 25th thru August 4th. An ATLAS language-based TPS has been selected to rehost. TYX's PAWS ATLAS development environment has been selected as tool set to perform the rehost tasks. The Warner Robins ATE, RADCOM, has been selected as the ATE to perform the TPSMS tasks on. Details of the RADCOM system, the LRU(s) and ITA fixtures will be pursued.

PROJECT: **Automatic Test Equipment (ATE) Synthetic Instrumentation**

OBJECTIVES: Depot avionics test stations typically remain in service beyond 20 years. In the past few years, a niche of COTS equipment has evolved by synthesizing the capability of multiple instruments and leveraging common core functions frequently replicated across a test system. In part, this evolution has resulted from the needs of the military customer to reduce total ownership costs associated with acquisition, operation, maintenance, and support of the ever-growing number of test systems in DoD inventory. By reducing the quantity of instruments needed to perform a given task, the corresponding burden associated with storage, documentation, mobilization, personnel training are also reduced. Also, technological advances have made it possible to achieve performance characteristics that previously could only be achieved with dedicated instruments, such as digital multimeters, oscilloscopes, counters, spectrum analyzers, etc. In order to demonstrate capabilities of this system, several F-15 avionics line replaceable unit (LRU) test program sets (TPS) will be integrated on this synthetic instrument-based test system. Upon successful completion of a formal demonstration at Boeing, this equipment will be relocated to Elmendorf Air Force Base where a 60-day user trial will be conducted with USAF maintenance and Boeing engineering personnel. Field demonstrations will establish the required assurances that the proposed synthetic instrumentation technology is mature and capable of supporting long-term depot production requirements.

PARTICIPANTS: Elmendorf AFB, WRALC, NADEP NI, JDMTP; Boeing; Teradyne; SEI;

STATUS: Procurement Activity –Approximately 99% of the procured equipment has been received at Boeing, including the Spectrum 9100 Core test station kit from Teradyne. Boeing is awaiting receipt of the Low Boy cabinet (1/2 rack assembly) from Teradyne and SIMU instrument from

PROJECT: **Barstow Air Pollution Control System (APCS) Improvements – Phase 2**

OBJECTIVES: To test the extent to which a biological treatment system can extend the operational life of the currently installed carbon bed in the Barstow APCS.To determine how successfully a biological treatment system can be integrated into ongoing operations, with minimal modification of current procedures, and using existing facility personnel to monitor and maintain the system.

PARTICIPANTS: USMC Barstow; NESA

STATUS: A pilot biological treatment system is installed, and is currently being tested on the Barstow paint line.

PROJECT: **Damage and Wear Assessment Using Condition-Based Monitoring**

OBJECTIVES: Assess the viability of an Acoustic Emission (AE)-based system for detecting damage, wear, misalignment, and lubrication problems for rotating equipment. Typical applications would be motors, pumps and support bearings.The intent of the project is to gather and analyze data to validate the types of equipment for which AE is best suited. This will be accomplished by extensive testing at several Depots and industry sites. In addition, several of the industrial sites currently use the more expensive VA approach, thus enabling a direct comparison between these technologies.

PARTICIPANTS: USMC Albany, RRAD, PNS, NADEP CP, Ford Motor Company, IMES, (formerly Water Weights); Wayne State University (WSU);

STATUS: Final Reporting remains delayed. Area of difficulty in completing the Final Report is with regard to financial implications/impact. Portsmouth nor USMC – Albany have provided any feedback despite repeated inquiries. This type of benefit documentation continues to be a problem

PROJECT: **Enhanced Wiring Integrity Systems (EWIS)**

OBJECTIVES: EWIS targets the implementation of new technologies: Standing Wave Reflectometry (SWR) and an Electrical Distribution Analyzer (EDA) to rapidly identify, localize, and verify platform wiring malfunctions and wiring system modifications. The EDA will have a scalable and open-ended architecture to permit increased test capability and technology enhancements. The project team will examine each component that transfers power and signals between electrical components for the candidate subsystems for each depot platform. This will include but not be limited to wiring, connectors, relays, circuit breakers, power distribution panels, and generators. Each component will be examined for the types of degradation that can (or are expected to) compromise its physical and functional integrity. All potential contributors to component degradation shall be delineated and the degradation defined.

PARTICIPANTS: OO-ALC; NADEP JAX; NADEP NI; PNS; TYAD; Elmendorf AFB; Eclypse International; Sikorsky Aircraft Company

STATUS: All site materials have been delivered and Eclypse is working with the sites to collect data. During this period, NADEP JAX continues to use the hardware and collect data testing circuit breaker panels. Data presented at the CTMA Symposium is as follows: Savings per aircraft – $6,778 Savings on 15 aircraft (annual aircraft flow) – $101,667 Projected Savings on all 120 aircraft – $800,000Return on investment – 135% Payback – 9 months. Portsmouth Naval shipyard has been using the equipment and data will hopefully follow. At **OO-ALC t**he one-end wing test was completed this period. Plans to test the program at the Tucson ANG were stopped. The test program has been delivered to OO-ALC and determination of testing the program has not been clarified at this time. At NADEP NI the testing of the first rewired C-2A aircraft took place. This effort was originally intended for a 6-week period but was cut short to just 4 weeks. Even given the shortened schedule, the effort completed over 80% testing of the aircraft and was considered a great success. The hardware was delivered to TYAD in March and the equipment is being used and data on the use should be forthcoming.

PROJECT: **Flat Wire Deposition**

OBJECTIVES: To demonstrate the feasibility of performing low heat input mobile near net shape manufacturing and repair on large, in-situ components. Integrated with a multi-axis motion robot, the Mobile-PMD system will operate on curved structures as well as on vertical or overhead surfaces.

PARTICIPANTS: NUWC Keyport; WR-ALC; H&R Technologies, Inc.; Precision Castparts; Goodrich Aerostructures; Chromalloy; Boeing

STATUS: Final Report is currently in progress.

PROJECT: **Heat Transfer Classification for Production Tooling and Composite Repairs**

OBJECTIVES: Improvements in computer power and sensors now enable higher quality composite manufacturing, and greatly reduced scrap as well. This project will develop and test tools to manage heat transfer for ovens and autoclaves used in the production and repair of composites. It has been estimated that over ten percent of engineering time is spend in the disposition of discrepancies related to problems related to cure cycle and heat transfer issues. The cost to the government is millions of dollars each year in scrapped parts, lost time, delays in returning weapons systems to service and lost opportunity to improve performance and reduce production costs. This project will help to optimize the manufacture and repair process, reducing scrap and increasing rates of readiness.

PARTICIPANTS: OO-ALC; CCAD; USAF Advanced Composites Office; AvPro; Vought; Adam Aircraft

STATUS: This project was recently approved. The first step is executing all the legal agreements, which is now underway.

PROJECT: **Replacement for Hexavalent Chromium in Surface Finishing Processes (a.k.a. Tri-Chrome)**

OBJECTIVES: Evaluate trivalent chromium pulse plating process for DoD specifications on trial parts.This project, although small in size, will have tremendous benefits should it prove successful. The replacement of hexavalent chromium has been a goal of the coatings industry for years and this unique application of electrochemistry has shown grown promise in an earlier project supported by the EPA. This project will attempt to use the technology to meet the more rigorous demands required for military applications.

PARTICIPANTS: NADEP CP; OC-ALC; Faraday Technologies

STATUS: Wear testing indicates that the new trivalent coating performs marginally better against hardened steel than the standard hexavalent coating. In direct wear testing of the standard coating rubbing against the new coating, the standard coating wears away the new one. However, this may turn out to be a plus for the new coating – it resists wear to itself as well as the standard, but is simultaneously less destructive to the surface it is rubbing against.A draft of the final project report has been received from Faraday, and is currently under final review and revision.

PROJECT: **Fixtures for Hard Chrome Plating**

OBJECTIVES: Introduce new electrodeposited hard chrome plating equipment into Department of Defense (DoD) maintenance activities, including advanced racks, fixtures, and anodes. This new tooling has many benefits over conventional hard chromium plating equipment, including faster plating rates, improved deposit uniformity, and reduced human exposure to carcinogenic compounds. Implementation of the new tooling into the Corpus Christi Army Depot (CCAD) plating facility. At this location, specific parts will be selected from current production activities. A baseline will be established by monitoring key production parameters (e.g. plating rates, uniformity of deposit, associated production costs). New tooling will then be fabricated, tested and changes in production parameters will be measured and documented. A set of production tooling will be provided to CCAD along with written instruction and training.Due to a heavy current production schedule at the CCAD plating facility, all project activities must and will be performed in a manner that does not interfere with CCAD production. This includes all project work including on-site testing and data collection.

PARTICIPANTS: CCAD; CAI Resources; Integrated Technologies

STATUS: Tooling was successfully tested at CCAD in January. Some refinements were made for further optimization, and were tested in June. A follow-on project is being organized.

PROJECT: **Isotropically Conductive Adhesives (ICA)**

OBJECTIVES: A world-wide legislative drive is underway to eliminate lead-containing solders from all electronics. Alternative lead-free solders have several problems: temperature, mechanical performance, wettability, and cost. Lead-free solder alloys have 34°C higher reflow temperature than eutectic lead solders which: degrades some electronic polymers, increases moisture related failure mechanism ("popcorning") in plastic encapsulants, necessitates new or refurbished reflow ovens, and adds cost and time to manufacturing. Isotropically conducting adhesives offer a low processing temperature solution. Through this CTMA program, the NCMS project team will develop a low-cost, corrosion-resistant, environmentally-friendly, copper-filled ICA that overcomes problems associated with lead-free solders and silver adhesives in most electronic applications.

PARTICIPANTS: WR-ALC; TYAD; NADEP CP; Foster-Miller; Henkel Loctite;

STATUS: Foster-Miller is currently attempting to scale the solution-based process for applying the ECORAP coating onto micron-sized copper powder. Coated powders from small-scale experiments were measured for electrical conductivity immediately after processing and after extended exposure to 85°C/85% RH in an environmental chamber. Some of these samples showed reasonably good conductivity retention after 40 days exposure to these conditions, while others corroded immediately. Prior to scale-up attempts during this quarter, good results were repeatedly obtained using solution processing three times. The variability was narrowed to what is believed to be the cleaning and preparation process prior to coating. All results that showed successful conductivity retention experienced varying degrees of agglomeration. This agglomeration was evident in SEM micrographs taken by Henkel-Loctite. While this agglomeration needs to be eliminated prior to a product being produced, it may not be accomplished during this program.

PROJECT: **Cold (Kinetic) Spray Processing**

OBJECTIVES: The projects aims to deliver a suitable technology "ensemble" (including hardware specifications, materials, operating parameters, and validation methods) for the application of kinetic-spray technology to the implementation of galvanic and barrier metallizations for improved corrosion resistance of ferrous and non-ferrous metals as specified by the participating depots. Furthermore, the industrial partner interests lie in development of understanding commercial infrastructure for kinetic-spray deposition of aluminum, aluminum alloys, zinc, and zinc alloys for the above mentioned corrosion protection of ferrous structures, as well as novel protection and restoration schemes for materials of construction including aluminum and magnesium, also known to be of related interest to the DoD.

PARTICIPANTS: USMC Albany; PM-LAV; Army Research Laboratory; B. Appleton & Co.; Boeing Defense; Boeing Commercial; Delphi; Ford; Solidica

STATUS: Kick-off meeting was held June 21, 2005 and project tasks have begun.

PROJECT: **Laser Coating Removal Systems (Phase I)**

OBJECTIVES: To investigate the feasibility of stripping paint or other coatings from fiberglass composite helicopter blades user advance laser technologies. Phase I will develop a qualification test plan, perform and report on qualification tests, provide an OEM approved depainting process, and provide detailed equipment specifications/Preliminary design documents for a unit to be designed and built in Phase II.

PARTICIPANTS: NADEP CP; NUWC Keyport; AFRL; JG-PP; Elmendorf AFB; UTC Sikorsky; General Lasertronics (GLC); Penn State ARL

STATUS: The design specification for the system is complete. All testing is complete with better than expected results, except for a mechanical strength test which will be redone in the next phase. The search for a system integrator partner for the next phase has been completed. System integration will be performed by Keyport NUWC and by Koops Engineering Inc. The final report was released in July 2005.

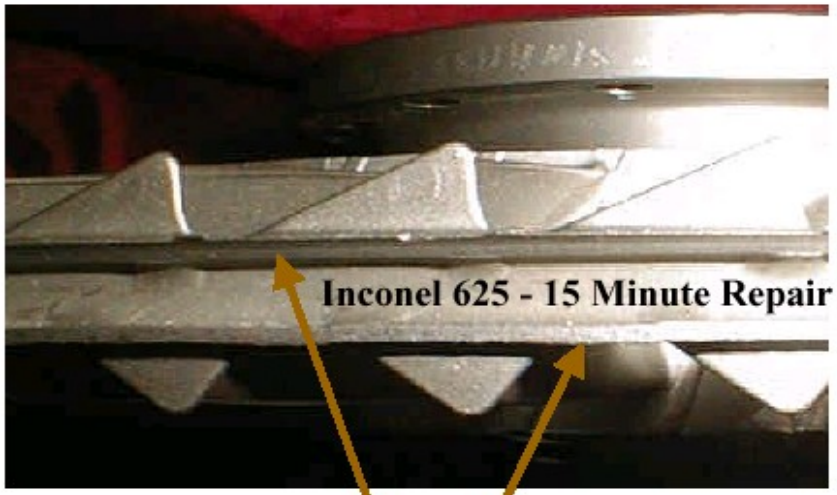
PROJECT: **Laser Engineered Net Shaping, Phase II**

OBJECTIVES: To advance the state-of-the-art of the LENS technology which was successful on the LENS I project. Advancements will include new material characterizations, more complex geometries of the target parts, and the design of a LENS unit more suitable to the environment of a repair depot. End result will be far greater applications of this technology at the various depots resulting in greater cost avoidance.

PARTICIPANTS: ANAD; NUWC Keyport; WR-ALC; NADEP CP; Rolls Royce; Boeing (UTC) Rocketdyne; Optomec

STATUS: Results, so far, have exceeded expectations. A product acceptance meeting for the 850R was held in May 2005 before unit installation at Keyport NUWC. A new, more efficient laser has just come on the market which would substantially increase the capability at Keyport if the team could upgrade to the new laser. The upgrade will cost an additional $80K and the team is currently seeking funding mechanisms to enable the upgrade. A cost sharing arrangement between Keyport and CTMA is envisioned. If the upgrade is made, it is anticipated that delivery to Keyport could be made by October 2005.

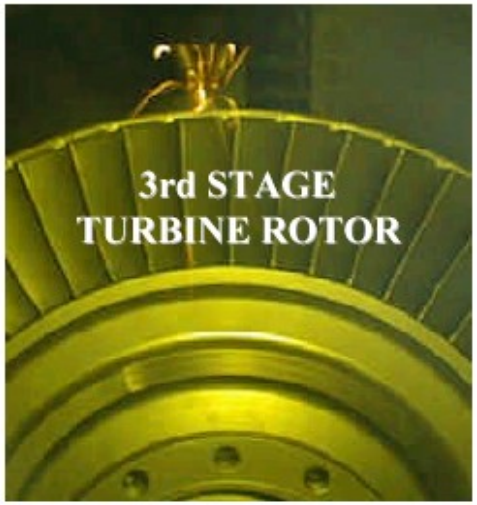
3rd Stage Turbine Rotor Repair



Area of Repair

.040”

Could not be repaired



Anniston Army Depot

Estimated Cost Savings

Inconel 625 - 15 Min

ITEM #1
Third (3rd) Stage Turbine Rotor

ITEM #2
Fourth (4th) Stage Turbine Rotor

ITEM #3
Second (2nd) Stage Nozzle

SS316 - 5 Min

ITEM #4
Compressor Stator 1st L.P.

LASER ENGINEERED NET SHAPING (LENS) - ESTIMATED PER YEAR COST SAVINGS

ITEM	PART	MATERIAL	PART NUMBER	NEW PART COST	ESTIMATED REPAIR COST	SAVINGS PER PART	PARTS REPAIRED PER YEAR	SAVINGS PER YEAR
1	Third (3rd) Stage Turbine Rotor	M3610C/Inconel 713LC	12271565	$ 8,297	$ 2,000	$ 6,297	230	$ 1,448,416
2	Fourth (4th) Stage Turbine Rotor	M3610C/Inconel 713LC	12281566	$ 5,485	$ 2,000	$ 3,485	230	$ 801,529
3	Second (2nd) Stage Nozzle	M3602/Inconel 713C	12286886	$ 6,032	$ 2,250	$ 3,782	600	$ 2,269,140
4	Compressor Stators (H.P. and L.P.)							
	1st L.P.	AMS 5510/321 Stainless	12302430	$ 910	$ 300	$ 610	175	$ 106,759
	2nd L.P.	AMS 5510/321 Stainless	12286249	$ 1,170	$ 300	$ 870	175	$ 152,264
	3rd L.P.	AMS 5510/321 Stainless	12286[illegible]	$ 610	$ 300	$ 310	175	$ 54,304
	4th L.P.	AMS 5510/321 Stainless	12286161	$ 611	$ 300	$ 311	175	$ 54,495
	5th L.P.	AMS 5510/321 Stainless	12302429	$ 701	$ 300	$ 401	175	$ 70,091
	1st H.P.	AMS 5504/410 Stainless	12286257	$ 604	$ 300	$ 304	175	$ 53,155
	2nd H.P.	AMS 5504/410 Stainless	12286261	$ 1,188	$ 300	$ 888	175	$ 155,377
	3rd H.P.	AMS 5504/410 Stainless	12286266	$ 575	$ 300	$ 275	175	$ 48,038
	4th H.P.	AMS 5504/410 Stainless	12286568	$ 1,893	$ 300	$ 1,593	175	$ 278,782
5	Fourth (4th) Stage Seal Runner	AMS 5662/Inconel 718	12286490	$ 319	$ 200	$ 119	600	$ 71,268
				$ 28,395	$ 9,150	$ 19,245		$ 5,563,617

Annual Cost Avoidance > $5 million

PROJECT: **High Productivity Portable Laser Depainting Device**

OBJECTIVES: A current CTMA project, has successfully demonstrated robotic laser stripping on helicopter blades that shows great promise on the shop floor. This proposed project goes further, exploring a new technology where the stripping rates approach 200 square feet per hour, and where the equipment can be moved to the weapon system to be stripped.

PARTICIPANTS: Elmendorf AFB; PHNSY; LEAD; PowerLaser; Pulse Systems; High Mesa Lasers

STATUS: After project approval, lead industrial member, PowerLaser, lost it's financial backing. Project funding has been de-obligated until industry support is re-established.

PROJECT: **Light Armor Vehicle (LAV) Condition-Based Maintenance**

OBJECTIVES: This project shall deploy and test new predictive condition-based maintenance methods for the Light Armored Vehicle (LAV) community located at Aberdeen Proving Ground, Maryland and the Marine Corps Logistics Base in Albany, Georgia and Barstow, California. To accomplish this task, a number of new and emerging technologies including diagnostic sensors, knowledge management data accessibility, remote support-based telematics, secure communication, condition based software algorithms, case-based reasoning, browser-based user interfaces and web portal data delivery shall be deployed, tested and integrated with and on legacy weapon systems.

PARTICIPANTS: USMC Albany; USMC Barstow; ANAD; US Army TACOM; USMC Aberdeen; Delphi; Portal Dynamics; Cubic Systems; Rochester Institute of Technology

STATUS: Final technical report was submitted to OSD on May 20, 2005.

PROJECT: **OptiCAM and I-POMX (Phase I and II)**

OBJECTIVES: Implement and validate a 3D image capture system that provides a solid model output and integrate the system with EDS' Team Center Product Lifecycle Data Management system (OptiCAM). Pilot a wireless Point-of-Maintenance tool, create lean business processes that support maintenance, and integrate the tool and system with UGS' Teamcenter Enterprise Product Lifecycle Data Management system.

PARTICIPANTS: OC-ALC; PHNSY; NADEP CP; PNS; PSNS; UGS; SIS Inc.; Solidica; MRI; Leszynski Group; Intel

STATUS: Project is completed. The Final Report for Phase II is in progress. Follow-on work at Tinker could go toward a limited implementation of electronic work control. OSD will require support of all ALCs plus AFMC.

Project: Product Lifecycle Management (PLM) for Six-Sigma Part Quality, Phase II

- The PLM for Six-Sigma project examines how commercially available software solutions could be deployed and integrated with reengineered business process to better meet the competitive challenges in manufacturing complex, highly-engineered components. Phase I of the PLM for Six-Sigma project addressed major opportunities for improving the way in which product design data is linked to the Quality plan and manufacturing information throughout the supply chain and product lifecycle from initial design to Depot maintenance. The pilot demonstration used a new production part similar to one that currently receives Depot maintenance at OC-ALC. Applying the savings across all new releases and engineering changes for a typical OEM yields benefits on the order of $11–15 million per year, a payback period of six months to one year, and ROI in the 100% to 200% range.

PROJECT: **Robotic Painting Optimization**

OBJECTIVES: Project embodies a development and demonstration protocol of the economic, technical and maintenance issues that, if successively executed through all phases, can substantially reduce the concerns that currently limit the use of robotic painting in DoD depots and in job-lot limited commercial operations. Phase 1 focuses on a thorough review of the Barstow physical facility and adaptation of the Statement of Work currently conceived to address physical facility needs, of the variables imposed by the actual demonstration vehicle available for use in the project, and the economic and maintainability concerns. Phase 2A will demonstrate the hardware, software and the human/software/hardware interface system capability for a full-scale system suitable for installation at Barstow. The demonstration will be at Pratt & Whitney Automation in Madison, AL.

PARTICIPANTS: USMC Barstow; USMC Albany; RRAD; Pratt & Whitney Automation; Vision Solutions Inc. (VSI); Penn State ARL

STATUS: Phase IIA initially fell behind schedule in Q1 due to commercial contract commitments on the part of P&W Automation, causing personnel unavailability to the project. (P&W Automation is contributing 100% of its effort as in-kind.) Subsequently during Q2, P&W Automation underwent a significant reorganization and the VSI - P&W Automation collaboration to address and coordinate various tasks of the Phase IIA plan was temporarily suspended during Q2. During July, the decision was made to endorse proceeding with the Phase IIA demonstration as robotic camouflage painting is viewed as important to the capability building at Barstow for handling the next generation of vehicles. The vehicle mix may be somewhat uncertain at this time, but the demonstration of technical feasibility can be done using the HMMVV.

PROJECT: **Smart Machines Pilot Project (SMPP)**

OBJECTIVES: Accomplish a Pilot Project to demonstrate Smart Machine functionality (focused on maintenance support) at depot and industrial project partner sites. This smart machine project will equip different selected machines at project partners' sites with the capability to automatically gather and report their performance in a consistent fashion. The cost/benefit ratio to gather and compile this information is radically changed for the better.

PARTICIPANTS: RRAD; NADEP CP; WR-ALC; Cincinnati Lamb; ATS; -Caterpillar; NIST

STATUS: Phase II planning completed and project has been submitted for review. For Phase II Vought Aircraft and Sikorsky Aircraft will be added as industrial pilot sites. Pearl Harbor, Hill AFB, and the B-2 Program Office are added. In Phase II the team will add interfaces to new types of equipment and begin looking toward the implementation of predictive functions.Completion of the Phase I Final Report is currently in progress.

Project: Static Event Detector Initiative

Since their inception, complementary metal-oxide semiconductor (CMOS) devices have been susceptible to electrostatic discharge (ESD) events. As electronic device features decrease in size, they become increasingly sensitive to ESD. Identification of ESD related device failures (immediate and latent) needs to be developed so that suspect devices and/or modules can be removed and replaced before the damage impacts system performance in the field. A Static Event Detector (SED) Health Monitoring system has the potential to alert inspectors or equipment operators to an ESD event that may have inflicted catastrophic damage resulting in a degraded weapon systems performance.

Studies by the University of Maryland and others have shown that over 50% of semi-conductor failures are due to ESD. Tobyhanna Army Depot has found $2.53 M of opportunity costs during a facility-wide workflow analysis that may be attributed to static discharge damage. This project will deliver at least three packaged and characterized detectors to the participants for evaluation/characterization at their facilities.

Emerging Projects for Remaining 2005 Funds

1. Durable Non-Skid Coating for Carriers
2. Assembly Design and Documentation
3. Smart Machine Pilot Project
4. Rapid Manufacturing Process & Material Insertion
5. Fault and Arc Location Tester (FALT)
6. Laser Stripping of Helicopter Blades, Phase II
7. OptiCam (II)

CTMA Project Launch Criteria

- Begins with a concept (~5 pages long)
- Joint Industry/DoD interest and needs
  - Hard deliverables, direct impact on manufacturing shop floor
- Cost/Benefits summary sketched out
  - Quantifiable
- Participant roles defined
- Letter of endorsement from base command
- Submission of concept to Pentagon (Office of Secretary of Defense)
- 30 day turnaround for approval…

Hurdles for New Project Ideas

- What new technology is being developed and implemented?
  - Not a mechanism for circumventing DoD procurement process.
- Is there cross-service involvement?
  - For broader dissemination of technology
- Is there sufficient industrial interest?
  - Greater than 2:1 cost share

Communications and Networking

- CTMA Website (http://ctma.ncms.org)
- The CTMA Connector Newsletter
- CTMA Working Symposium on Sustainment:
  3-6 April 2006, Williamsburg, VA

Thank You

Questions?